[10] Allison Abbott, "Missing Dinosaur Skulls Raise New Fears of Smuggling in Moscow," *Nature* 384: (1996): 499.
[11] ibid.
[12] ibid.
[13] Allison Abbott, "Moscow's 'Missing Fossils' Come Under New Scrutiny," *Nature* 391: (1998): 724.
[14] ibid.
[15] Allison Abbott, "Fossil Dealer Charged over Russian Cache," *Nature* 397: (1999): 189.
[16] <http://www.elasmo.com/leecreek/other_pg/news9901.html#holotype_found> provides details as well as a photograph of the specimen.
[17] Andrea Arcucci, "Stolen Fossils," *Society of Vertebrate Paleontology News Bulletin* 161: (1994): 62.
[18] Peter Wellnhofer, "Missing *Archaeopteryx*," *Society of Vertebrate Paleontology News Bulletin* 155: (1992):53-54.
[19] Anonymous, "Cleveland-Lloyd Dinosaur Quarry Suffers Break-In." *Al's Archives, Newsletter for Paleontology, Archeology, and Natural History Enthusiasts* 13:2 (Winter 1996), College of Eastern Utah's Prehistoric Museum, Price, Utah: no pagination.
[20] <http://www.netscape.org/users/herald/issues/100196/brief4.f.html>
[21] Dr. Brooks B. Britt, personal communication, 1999.
[22] The University of California (Berkeley) press release on the theft and recovery, including a photograph of the specimen, is available at <http://www.urel.berkeley.edu/urel_1/CampusNews/Press Releases/releases/7-2-1999.html>.
[23] Muriel Ishikawa, Lowell Wood, James I. Kirkland, and Kenneth Carpenter, "Gamma Watermarking of High-Value Specimens for Robust Establishment of Provenance," *Journal of Vertebrate Paleontology* 19, suppl. to no. 3 (1999): 54A.
[24] See the FBI National Stolen Art File at <http://www.fbi.gov/majcases/arttheft/art.htm> as one of many examples.
[25] <http://www.artloss.com/>
[26] A. Abbott, "Moscow's Missing Fossils," *Nature* 391.

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Biological Inventories to Use Museum Voucher Information

Fiscal year 2000 marks the first year of the National Park Service (NPS) Natural Resource Challenge, a five-year initiative designed to revitalize natural resource management throughout the Service. One of the major goals of the Challenge is to accelerate completion of the basic natural resource inventories being funded through the Servicewide Natural Resource Inventory and Monitoring (I&M) Program. Those basic inventories consist of 12 biological and geo-physical datasets and are being completed in approximately 270 parks throughout the nation. In FY 2000, the I&M Program received a base increase of approximately $7.3 million. With that increase, the program expects to complete the basic resource inventories over a period of about eight years. One of the inventories receiving emphasis in FY 2000 is biological resources.

Goals of Biological Resource Inventories

The basic goal of the biological inventory program is to provide park managers with comprehensive, scientifically-based information about the nature and condition of selected biological resources occurring within park boundaries. The information will be presented in a form that increases the accessibility and utility for making management decisions, for scientific research, and for educating the public. The inventories will also lay the groundwork necessary for park managers to develop effective monitoring programs and to formulate effective management strategies for resource management and protection. To attain these basic goals, biological inventories have been designed to meet three basic objectives:

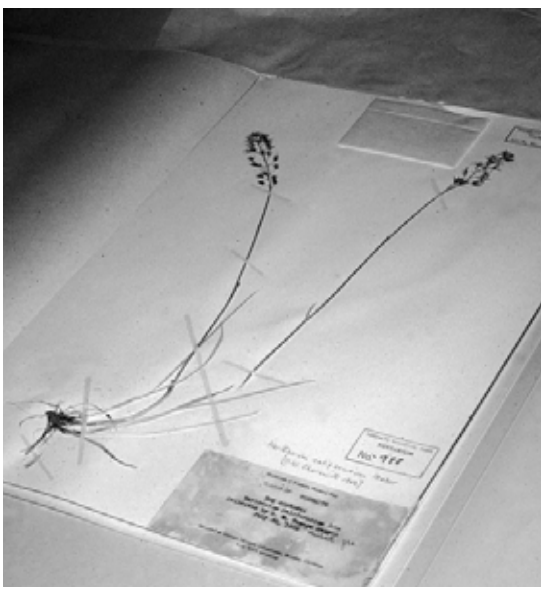
- To document through existing, verifiable data and targeted field investigations the occurrence of at least 90% of the species of vertebrates and vascular plants currently estimated to occur in the park

- To describe the distribution and relative abundance of species of special concern, such as Threatened and Endangered species, exotics, and other species of special management interest occurring within park boundaries
- To provide the baseline information needed to develop a general monitoring strategy and design that can be implemented by parks once inventories have been completed, tailored to specific park threats and resource issues

Conducting field inventories for biological resources can be very costly and time consuming. Therefore, major attention is being given to conducting the inventories in the most cost-effective manner. One way costs are being minimized is by conducting the inventories in networks of parks, rather than in individual parks. Previous efforts have shown that significant cost savings and efficiencies can be realized by working simultaneously in several parks in close proximity to each other. Therefore, all natural resource parks included in the biological inventory program have been organized into 32 separate park networks. These networks are essentially the same as those that will be utilized for ecological monitoring efforts in the future.

Museum Voucher Searches

Another way that cost of the biological inventories is being minimized is by making maximum use of existing information, especially that available from examination of voucher specimens in parks and non-NPS museum and herbaria collections. The NPS has spent considerable amounts of funding in previous years conducting inventories for many species of vertebrates and vascular plants in parks. In this respect, it will be important for the NPS to be able to provide "evidence" that these particular species occur in parks or at least have been known to occur in the park at some time in the past. Information about the historical presence in parks is critical, especially if more recent surveys do not find the species in the park. Information on vouchers is being gathered through both centralized efforts and by the efforts of individual parks or park networks.



Botanical specimen collected in 1922, Yosemite National Park, (Catalog Number YOSE 65895). Photo by Ann Hitchcock, Museum Management Program, National Park Service.

Central Office Searches. The I&M Program Office in Fort Collins, Colorado, is reviewing the NPS Automated National Catalog System (ANCS+) data for voucher specimens that are in park collections. In addition, the Program will organize and conduct systematic searches of major museums and herbaria where voucher specimens of vertebrates and vascular plants collected in parks are likely to be found. These searches will be conducted both online and, when necessary, by having I&M staff visit the museum or herbarium. Major museums, such as the Smithsonian Institution, are known to house considerable numbers of voucher specimens of species collected in parks over the years. In April 1999, I&M Program staff met with personnel from the Smithsonian to discuss online availability of voucher specimens. Availability varies considerably by taxonomic group. Specimens of mammals are generally available online, but collections of other taxa, especially fish, are not available online.

To supplement the online searches of museum and herbaria records, the I&M Program plans to hire research associates through Colorado State University to travel to major museums and herbaria to conduct on-site searches of databases and other sources available on site for information about vouchers from park locations. But, the research associates will not examine actual specimens or make an attempt to confirm taxonomic accuracy of the collections.

Park-Based Searches. Parks facilitate the I&M Program Office searches of ANCS+ and also search non-electronic catalog records for vouchers in park collections. In addition to the centralized searches of non-NPS museums and herbaria organized and conducted by the I&M Program Office, the Program will provide parks and park networks with funding to query other museums and herbaria in their immediate area to learn of the presence of vouchers collected in parks in that network. An example of how this

Small mammal storage, Yosemite National Park. Photo by Michael Dixon, Yosemite National Park, National Park Service.

process might work in parks throughout the Service is found in an effort by parks in the Northeast Region.

In preparation for conducting new field inventories for Northeast Region parks, the region has contacted the Carnegie Institute and other museums and universities in the region to locate voucher specimens, which were collected in those parks. The region has encountered difficulties in this effort, including: the museums often lack electronic databases that catalog their holdings; and the generalized locational information associated with some vouchers makes it difficult to determine if those particular specimens were actually collected within the park boundaries. The region has found that one efficient way of locating collections is to begin with the collection permits obtained from the park. It is often possible to determine from those historical records what species were collected and where the voucher specimens might be located.

A second example is found at Denali National Park in Alaska. In 1998, the I&M Program provided Denali National Park with a limited amount of funding to begin the development of a vascular plant database for the park. A portion of that funding was provided to Dr. John Kartesz from the University of North Carolina. Dr. Kartesz constructed a preliminary database containing a listing of species, which could potentially occur in the park, based upon information abstracted from a national database he maintains on species locations at the county level and other sources. The park provided ANCS+ data on cataloged species from the park and repository locations for the specimens. Dr. Kartesz examined all vascular plant specimens in the park's collection. He then searched records maintained at the University of Alaska in Fairbanks to locate voucher specimens, which confirmed the species occurrence in the park. Other species listings for Denali National Park were obtained from the University of California, Berkeley, Alaska Pacific University, and the Alaska State Historical Museum, where additional vouchers were identified.

Voucher Specimen Database

The I&M Program is also developing a species database, called NPSpecies, to document the present, past, and probable occurrence of vertebrates and vascular plants in NPS units. The program is developing the database in Microsoft Access format for distribution to individual parks. A second, Internet-based version in Oracle is also being developed. The database is expected to be completed in FY 2001.

Two major data categories in NPSpecies are a species checklist and the supporting evidence. Each park's checklist will include data about federal and state threatened and endangered status, The Nature Conservancy Global Rank, abundance, residency, and nativity.

Voucher information will be included in the NPSpecies database as one of three separate forms of evidence. Other forms will include references, such as journal articles or reports, and documented observations. A concerted effort is being made to interface the NPSpecies database with the ANCS+ database maintained by parks and the NPS Cultural Resources Directorate. Several of the data fields in NPSpecies that pertain to vouchers also occur in ANCS+. Information about vouchers in parks contained in ANCS+ is being imported into NPSpecies. Although there are currently no physical linkages between NPSpecies and ANCS+, it may be possible in the future to construct those linkages through the fields in each database that contain information on species ID and location.

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CRM Online Exclusive

For a table describing the variables in the NPSpecies and ANCS+ databases related to voucher records, go to *CRM Online* at <http://www.cr.nps.gov/crm>.